GEJ-3821

OPERATING MANUAL

MODEL U50 DIESEL-ELECTRIC LOCOMOTIVE

GENERAL ELECTRIC

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OPERATING MANUAL

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GENERAL ELECTRIC MODEL U-50 DIESEL-ELECTRIC LOCOMOTIVE

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

Do not order parts from plates in this publication.

GENERAL ELECTRIC

9-63 (500)

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GENERAL DATA

MODEL	U50 - 5000 hp
TYPE (AAR SYMBOL)	B-B-B-B
MAJOR DIMENSIONS	
Over-all Length Inside Knuckles	83 ft 6 1/2 in.
Over-all Width	10 ft 6 1/2 in.
Over-all Height Above Rail	16 ft 7 1/4 in.
Length Between Center Plates	41 ft 6 in.
Total Wheel Base	63 ft 1 in.
Truck Wheel Base	9 ft 4 in.
DRIVE	
Traction Motors	Eight-GE-752
Wheel Diameter	40 in.
WEIGHT	
Total Weight (Fully Loaded)	554, 000 lb
Per Axle (Fully Loaded)	66, 750 lb
Truck	43, 500 lb
SUPPLIES	
Fuel	5850 gal
Engine Lubricating Oil Per Engine	385 gal
Cooling Water Per Engine	290 gal
Governor Oil Per Engine	2 qt
Sand	60 cu ft
MAJOR EQUIPMENT	
Diesel Engines	Two-General Electric 7FDL-16
Traction Generators	Two-GT-598
Traction Motors	Eight-GE-752
Auxiliary Generators	Two-GY-27
Exciters	Two-GY-50
Fan and Blower Units	Two-GDY-44
Braking Resistor Blowers	Two-GY-19
Air Compressor	Two-3CWDL
Air Brake System	24RL

OPERATING CONTROLS

INTRODUCTION

The power plants of this locomotive and each of their systems are completely independent of each other. The fuel supply and battery are the only items common to both.

All of the operating devices, manual and visual, normally used by the engineman during locomotive operation are located near the operator's position. Most of these devices are located either on the master controller, on the air brake stand, or on the engine control panel.

MASTER CONTROLLER

The master controller is a set-up switch used by the operator to control the locomotive. It has a throttle handle, a selector handle, and a reverse handle. These handles control motoring and dynamic braking. Various control switches, circuit breakers, and indicating lights are mounted on the housing of the controller.

Mechanical interlocking between the handles prevents improper operation of any handle. (See INTERLOCKING BETWEEN HANDLES.)

THROTTLE HANDLE (Fig. 1 AND 2)

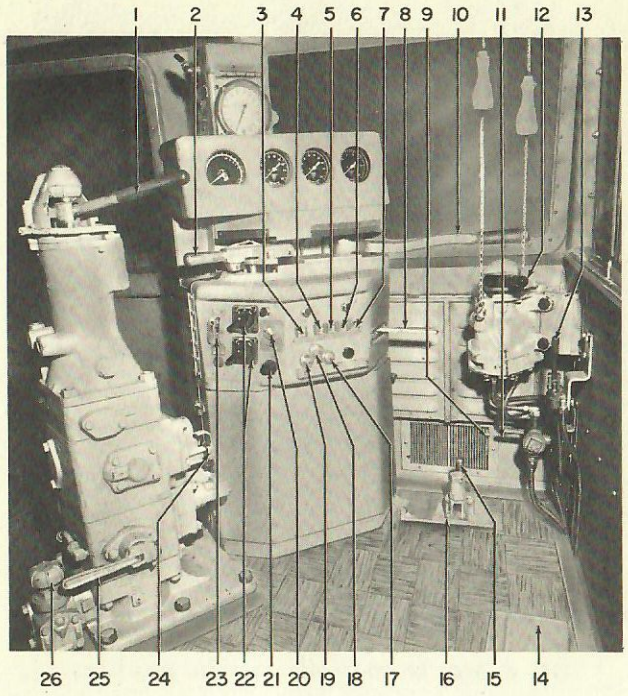
The throttle handle has an IDLE and 8 major and 8 intermediate positions or notches. Major notches are registered by a number. Intermediate notches are registered by a dot or 1/2 mark. This handle controls tractive effort when motoring and braking effort when dynamic braking is being used.

REVERSE HANDLE (Fig. 1 AND 2)

The reverse handle has positions FORWARD, OFF, and REVERSE. It is used to control the direction of locomotive movement.

OPERATING CONTROLS

Fig. 1. (E-11948)



1	Automatic brake valve	14	Auxiliary cab heat (Engineman)
2	Selector handle	15	Overspeed warning whistle
3	Power limit switch	16	Safety control pedal
4	Automatic sanding switch	17	Emergency sand light
5	Emergency sanding switch	18	Wheel-slip light
6	Step light switch	19	Brake warning light
7	Gage light switch	20	Emergency shutdown switch
8	Reverse handle	21	Call button
9	Emergency heat control	22	Headlight switches
10	Throttle handle	23	Generator-field circuit breaker
11	Double cut-out cock	24	Safety control cut-off
12	Independent brake valve	25	Brake-pipe cut-out cock
13	Manual sanding control	26	Feed valve

Fig. 1. Engineman's position

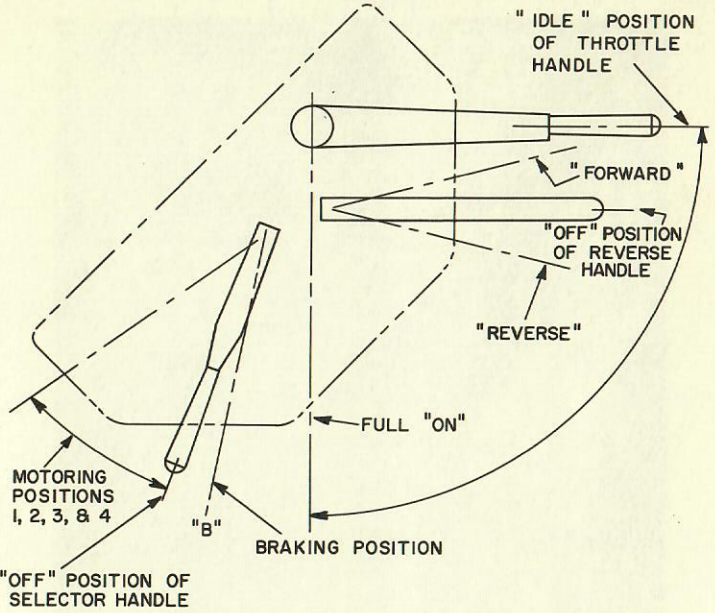


Fig. 2. (E-10102A)

Fig. 2. Master controller handle positions

SELECTOR HANDLE (Fig. 1 AND 2)

The selector handle has positions 4, 3, 2, 1, OFF, and B. The numbered positions are used when motoring. Position B is used when in dynamic braking.

In ordinary operation, since the U50 locomotives are equipped with automatic transition, the selector handle may be placed in position 1 during motoring and left there.

Positions 2, 3, and 4 are used to provide transition for any locomotive units which are in multiple operation and are not equipped with automatic transition. Handle movement is governed by transition speed of other locomotive units in the consist.

INTERLOCKING BETWEEN HANDLES

Interlock between handles of the master controller is governed in the following manner:

1. The reverse handle can be taken out only when in the OFF position. The selector handle must also be in OFF or 1 and the throttle handle in IDLE position.

2. The reverse handle cannot be moved unless the selector handle is in OFF or 1 and throttle handle is in IDLE.

3. The throttle handle cannot be advanced from IDLE unless the selector handle is in 1, 2, 3, 4, or B.

4. The throttle handle can be moved with the reverse handle in any position.

5. The selector handle cannot be moved into B (braking) unless the throttle handle is in IDLE and the reverse handle is in FORWARD or REVERSE.

DEVICES ON MASTER-CONTROLLER HOUSING (Fig. 1)

The following operating devices are located on the master controller housing:

M.U. Emergency Shutdown Switch

This switch has two positions, STOP and RUN. The normal position is RUN. When this switch is turned to STOP, the diesel engines on all units in multiple unit locomotive consist will shutdown.

This switch is provided for emergency use only. Normal shut-down should be made by moving the throttle to IDLE, each engine control switch (EC) to START, and depressing the STOP buttons on the engine control panel.

After an emergency shut-down, the engine control switches (EC) must be turned to START and engine(s) must be restarted in the normal manner.

Power Limit Switch

This switch has two positions, NORMAL and NOTCH 7. When locomotive units of the same horsepower are operated in the locomotive consist, this switch is ordinarily in NORMAL position.

When the leading unit is slipping excessively, the power limit switch can be moved to NOTCH 7 to reduce power while the trailing units are operating at full power. This will reduce the tractive effort on the front four motors of the leading unit and will usually improve the ability of the locomotive to hold the rail under bad rail conditions.

Other Switches

a. Front Headlight – OFF-DIM-BRIGHT.

b. Rear Headlight – OFF-DIM-BRIGHT.

c. Step Lights.

d. Gage Lights and Dimmer Control.

e. Emergency Sanding.

When in the ON position will provide forward and reverse sanding on all units and will light the emergency sanding light.

f. Automatic Sanding.

When in the ON position will allow automatic sanding on all units in the direction of motion, when a signal is received from a trailing non G-E unit.

Call Button

Call button is used to sound alarm bell in all locomotive units.

Wheel-slip Light

Light indicates when a pair of wheels are slipping on any unit.

Brake Warning Light

Light indicates that safe dynamic braking limit has been exceeded on any unit.

Emergency Sanding Light

Light indicates that the emergency sanding switch is in the ON position.

Generator-field Circuit Breaker

The generator-field circuit breaker is ON whenever the locomotive is powered. The breaker may also be used to keep the main generator de-energized when it is necessary to run the engine(s) at speeds higher than idle.

ENGINE CONTROL PANEL

The engine control (EC) panel is located on the rear wall of the operator's cab (see Fig. 3). Mounted on this panel are various other switches, circuit breakers, and operating devices used during locomotive operation.

The control circuits on the left side of the panel are used for the front engine (No. 1) and its control circuits. The controls on the right side of the panel are used for the rear engine (No. 2) and its control circuits and includes the ammeter for the No. 8 traction motor.

The controls in the center of the panel, set against the green background, are common to the circuits of both power plants.

OPERATING CONTROLS

ENGINE CONTROL SWITCH (Fig. 3)

Each engine control switch has two positions, START and RUN. The Engine Start button is effective only when the EC switch is in the START position.

When the engine is running and the EC switch is in START position, engine speed is held at IDLE and power cannot be applied to the locomotive. The affected power plant is said to be "off the line."

When the engines are idling and the locomotive is to be operated, each engine control switch (EC) must be moved to the RUN position.

ENGINE START AND STOP BUTTONS (Fig. 3)

To start either diesel engine, depress the appropriate ENGINE START button firmly and hold until the engine starts. To stop the engine, depress the STOP button momentarily.

The engine start button is effective only when the engine control switch (EC) is in the START position.

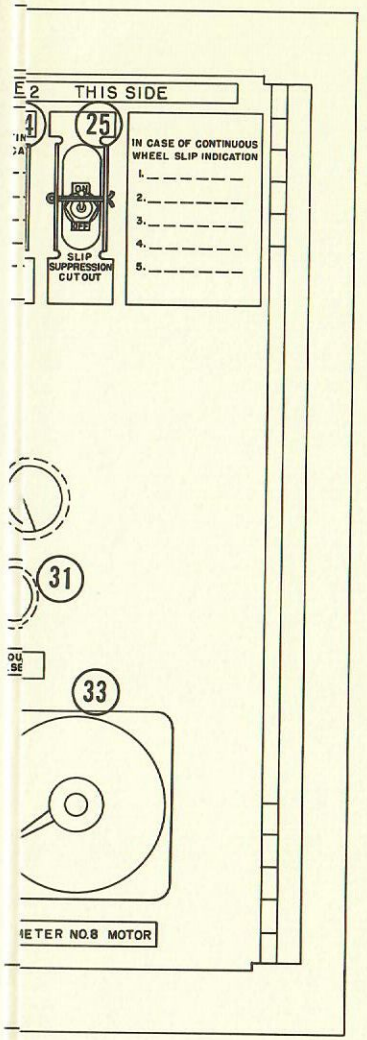
M.U. HEADLIGHT SET-UP SWITCH (Fig. 4)

The M.U. HEADLIGHT SET-UP SWITCH has five positions. Positioning of this switch is determined by location of the locomotive unit in the consist and whether the front of the locomotive unit is leading or trailing. Switch positions are as follows:

SINGLE OR MIDDLE UNIT Place switch in this position on any locomotive unit operated singly or on all units except the leading or trailing unit, when the locomotive consist is made up of more than two units.

SHORT HOOD LEAD – LEADING UNIT Place switch in this position when leading unit is operated with the short hood forward.

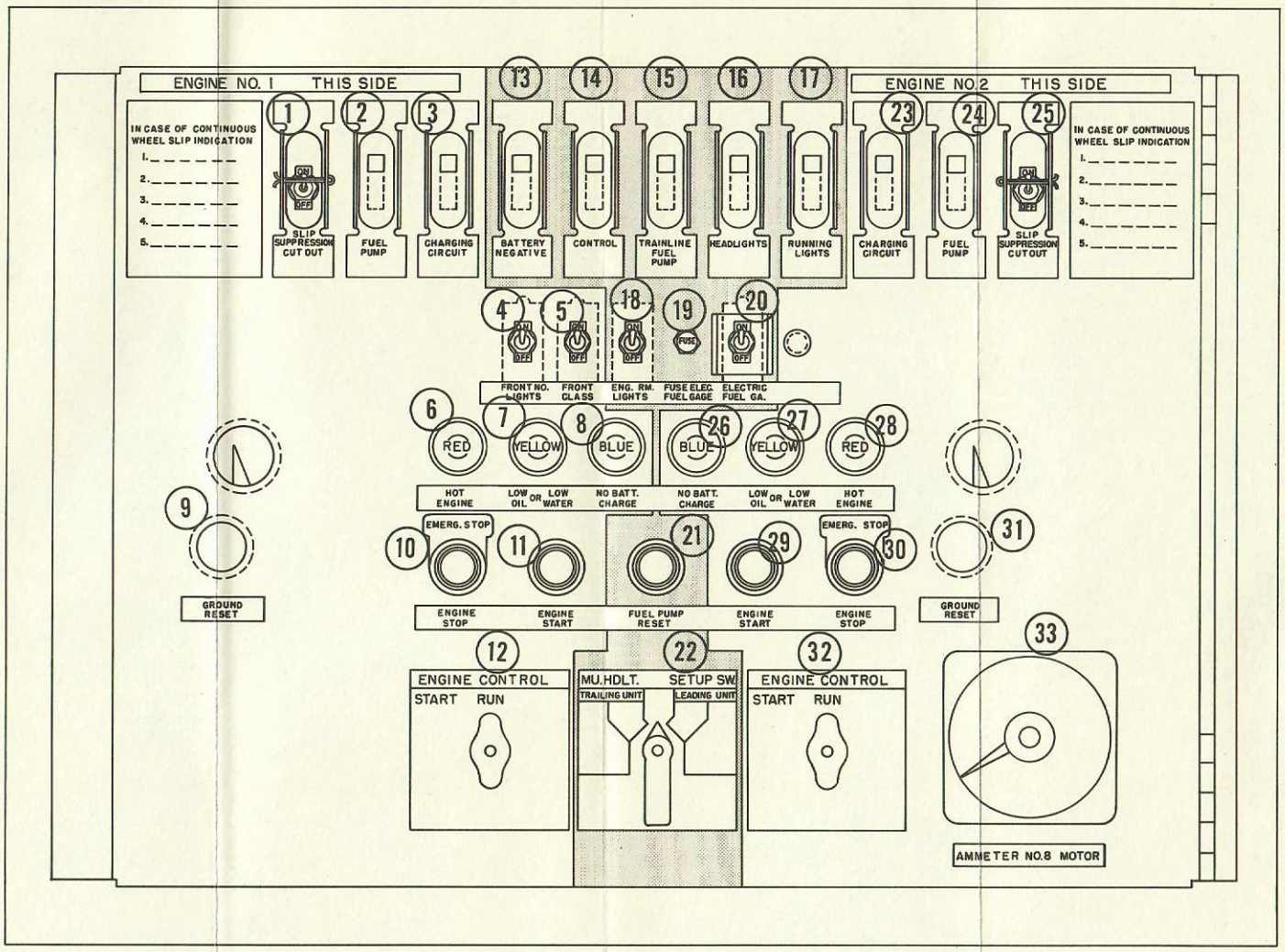
Fig. 3. (E-11936)



FONTROLS

1 it breaker
2 cuit breaker
3 on cut-out
4 arge light
5 -water light
6 t
7 itton
8 tton
9 eset
0 switch
1 nmeter
2

ig. 3. Engine control panel



FRONT ENGINE CONTROLS

1 Slip-suppression cut-out
2 Fuel-pump breaker
3 Charging circuit breaker
4 Front number lights switch
5 Front class lights switch
6 Hot engine light
7 Low-oil or low-water light
8 No battery charge light
9 Ground relay reset
10 Engine stop button
11 Engine start button
12 Engine control switch

COMMON CONTROLS

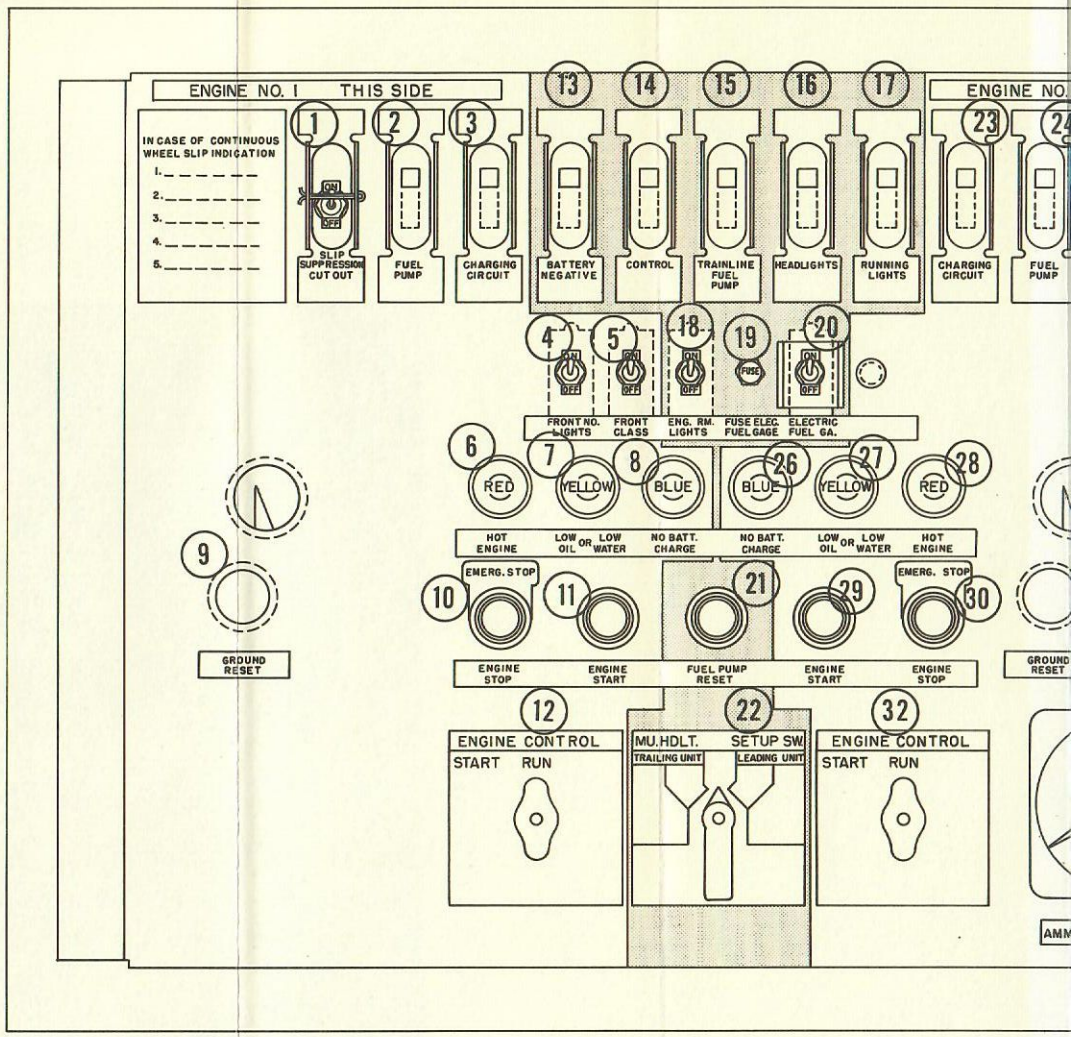
13 Battery negative breaker
14 Control breaker
15 Trainline fuel-pump breaker
16 Headlights breaker
17 Running lights breaker
18 Engine room light switch
19 Electric fuel-gage fuse
20 Electric fuel-gage switch
21 Fuel-pump reset button
22 M. U. headlight set-up switch

REAR ENGINE CONTROLS

23 Charging circuit breaker
24 Fuel-pump circuit breaker
25 Slip-suppression cut-out
26 No. battery charge light
27 Low-oil or low-water light
28 Hot engine light
29 Engine start button
30 Engine stop button
31 Ground relay reset
32 Engine control switch
33 No. 8 motor ammeter

Fig. 3. Engine control panel

Fig. 3. (E-11936)



FRONT ENGINE CONTROLS

1 Slip-suppression cut-out
2 Fuel-pump breaker
3 Charging circuit breaker
4 Front number lights switch
5 Front class lights switch
6 Hot engine light
7 Low-oil or low-water light
8 No battery charge light
9 Ground relay reset
10 Engine stop button
11 Engine start button
12 Engine control switch

COMMON CONTROLS

13 Battery negative breaker
14 Control breaker
15 Trainline fuel-pump breaker
16 Headlights breaker
17 Running lights breaker
18 Engine room light switch
19 Electric fuel-gage fuse
20 Electric fuel-gage switch
21 Fuel-pump reset button
22 M. U. headlight set-up switch

REAR ENGINE CO

23 Charging circu
24 Fuel-pump cir
25 Slip-suppressi
26 No. battery ch
27 Low-oil or low
28 Hot engine ligh
29 Engine start bu
30 Engine stop bu
31 Ground relay r
32 Engine control
33 No. 8 motor a

F

OPERATING CONTROLS

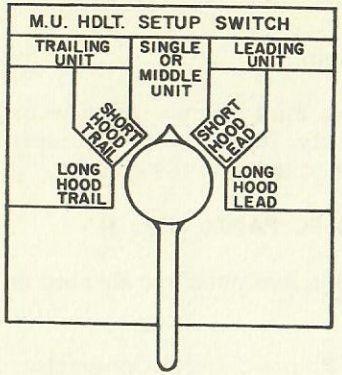


Fig. 4. (E-11960)

Fig. 4. M.U. headlight set-up switch

LONG HOOD LEAD – LEADING UNIT Place switch in this position when leading unit is operated with the long hood forward.

SHORT HOOD TRAIL – TRAILING UNIT Place switch in this position when final trailing unit is connected so its short hood trails.

LONG HOOD TRAIL – TRAILING UNIT Place switch in this position when final trailing locomotive is connected so its long hood trails.

CIRCUIT BREAKERS ON EC PANEL (Fig. 3)

The following circuit breakers are located on the engine control panel:

1. Charging Circuit – Isolates battery-charging generator from the control system.

2. Battery Negative

3. Running Lights (all lights except headlights)

4. Headlights

5. Control

6. Fuel Pump

7. Trainline Fuel Pump – Must be in the ON position on the lead unit only. It is used in an emergency to shut down all fuel pumps of units in the consist.

SWITCHES ON EC PANEL (Fig. 3)

The following switches are located on the engine control panel:

1. Engine-Room-Control Compartment Lights

2. Front Classification Lights

3. Front Number Lights

4. Electric Fuel Gage – Turn to OFF to isolate circuit if an electrical ground should occur.

5. Slip-suppression Cut-out – Normally this switch is sealed in the "UP" (closed) position. The switch should only be opened as directed by railroad regulations.

GROUND RELAY (Fig. 3)

The ground relay is furnished for each power plant to protect the power and control circuits. An indication pointer moves to a red dot when the relay has tripped. The proper reset button must be pushed to reset the relay.

ELECTRIC FUEL GAGE FUSE

A 1/8 ampere fuse is mounted adjacent to the electric fuel gage switch to protect against electrical failure.

TRACTION MOTOR AMMETER

The ammeter mounted on the EC panel registers traction-motor current for the rear power plant. Traction-motor current for the front power plant is indicated on the instrument panel in front of the operator.

MISCELLANEOUS CONTROLS

In addition to the afore described operating devices, the following other controls are used by the engineman during locomotive operation.

1. Bell Valve – Mounted on the ceiling above engineman's position.

2. Horn Valve – Mounted on the ceiling of the operator's cab. Operated by a pull cord.

3. Sander Control – Mounted on the right side wall of the engineman's position. (See Fig. 1.)

4. Windshield Wiper Valves – Located on the ceiling over the engineman's and helper's positions.

5. Hand Brake – Located on rear end of the locomotive platform.

6. Helper's Emergency Valve – Knob located in front of the helper's position. Pulling this knob causes a full emergency brake application and dropping of power.

7. Emergency Fuel Cut-off System – In an emergency, to cut off fuel delivery and shutdown both engines, press both engine stop buttons on the EC panel or either of the emergency push buttons located on either side of the locomotive near the front of the fuel tank.

> **NOTE:** *The emergency push button is used to shut down the engines on one unit only. The emergency shutdown switch on the master controller is used to shutdown the engines on all units of the consist. The engine stop buttons on the EC panel are also normally used to shutdown each engine separately or in an emergency to push both buttons to shutdown both engines at once.*

OPERATING CONTROLS

8. Fuel-trip Reset Button – The fuel-trip reset button on the engine control panel must be depressed before pushing the engine start button and after any emergency fuel trip button has been depressed.

9. Cab Heat – Normal Cab Heat (hot water) at the engineman and helper positions is available whenever the front engine (No. 1) is running and warm. Heat is regulated by the upper two valves on the helper's side of the nose compartment.

Auxiliary Cab Heat (electrical) is available when either engine is running or the battery switch is closed, by closing the auxiliary heater switch of the engineman and helper positions.

CAUTION: PROLONGED USE OF AUXILIARY CAB HEAT WITHOUT RUNNING EITHER OF THE ENGINES WILL EVENTUALLY RUN-DOWN THE LOCOMOTIVE BATTERY.

Emergency Cab Heat (electrical) is available whenever the rear engine (No. 2) is running and the emergency cab heater switch on the rear wall of the operators cab is closed.

CAB HEAT AVAILABLE

CAB HEAT	BOTH ENG. RUN	NO. 1 ENG. RUN	NO. 2 ENG. RUN	BATT. CLOSED
HOT WATER	X	X		
ENGINEMAN AUX.	X	X	X	X
HELPER AUX.	X	X	X	X
EMERGENCY	X		X	

CAUTION: TO PREVENT HEATERS FROM FREEZING IN COLD WEATHER, LEAVE VALVES OPEN AT ALL TIMES.

OPERATING CONTROLS

10. Window Defrosters – The heat for window defrosting is controlled by the same regulating valve which controls hot water cab heat.

11. Cab Ventilation – Cab ventilation is controlled by positioning the hand operated lever near the floor in the nose compartment.

AIR BRAKE EQUIPMENT

Schedule 24RL equipment, arranged for single-end, multiple-unit operation, is used on this locomotive. The equipment consists primarily of the automatic brake valve, independent brake valve, brake-pipe cut-out cock, feed valve, and the D-24 control valve.

AUTOMATIC BRAKE VALVE HANDLE

The automatic brake valve handle controls the train and locomotive brakes. It has six positions which function as follows:

1. RELEASE POSITION – This position gives full release of train and locomotive brakes using main reservoir pressure. A warning port blows to inform the engineman of the handle position.

2. RUNNING POSITION – This position releases the brakes by air flow to the brake pipe as regulated by the feed valve. The handle is left in this position when the brakes are not required.

3. FIRST SERVICE POSITION – This position provides an initial normal service rate of brake-pipe reduction sufficient to indicate quick service on the train brakes, after which a slower rate is imposed. This allows brake-pipe pressure to readjust itself throughout the train to avoid a heavy reduction at the front end.

4. LAP POSITION – This position holds the brakes as applied after a service application until it is desired either to increase or to release the brakes.

5. SERVICE POSITION – This position produces the proper rate of brake-pipe reduction to cause a service brake application, applying locomotive and train brakes uniformly. This is accomplished by the displacement reservoir, which delays the beginning of brake-cylinder pressure on the locomotive to coincide with that on the

train brakes. Handle location in the service zone determines the amount of braking to be developed. Braking is increased by moving the handle away from the operator.

6. EMERGENCY POSITION – This feature provides a rapid increase in locomotive brake-cylinder pressure for stopping short trains; or a controlled build-up for stopping long trains.

INDEPENDENT BRAKE VALVE HANDLE

The independent brake-valve handle is used to apply and release the brakes on the locomotive only. It can also be used to release the brakes on the locomotive after an automatic or emergency application while the train brakes are still applied. The handle has a release position and an application zone.

Braking is achieved by moving the handle from the extreme left, release position, to the extreme right, full application position. The application zone is between these positions. An independent brake application can only be released by moving the brake-valve handle to the release position. An automatic service or emergency application can be released on the locomotive by depressing the brake-valve handle while it is in the release position. The brakes can also be released in any other position of the handle but will reapply when the independent handle is allowed to raise again.

FIRST SERVICE CUT-OUT COCK

The first service cut-out cock is located on the back side of the automatic brake valve. It is used to cut-in or out the first service operation of the brake valve. When the handle is in the vertical position, first service is cut-in.

BRAKE PIPE CUT-OUT COCK

The brake pipe cut-out cock is located on the lower front portion of the automatic brake valve. It is used to

cut the brake-valve operation in or out for multiple-unit operation. When the handle is in the horizontal position the automatic brake valve is cut-in (OPEN).

SAFETY CONTROL CUT-OUT COCK

The safety control cut-out cock is located on the lower right side of the automatic brake valve. It is used to cut in or out, all safety devices (safety control, locomotive overspeed and train control if used). When the handle is in the down position all safety devices are cut in.

TYPE D-24 CONTROL VALVE

The D-24 control valve is located in the right, air-brake rack. When actuated by the automatic brake valve, it operates to charge, apply, and release the brakes on the locomotive. The release cap on the control valve can be mounted for direct or graduated release of the automatic brakes, depending on railroad rules.

DUPLEX AIR GAGES

The following air gages are located on the gage panel in front of the engineman:

1. Main Reservoir – Equalizing Reservoir – Red hand indicates main reservoir pressure; white hand indicates equalizing reservoir pressure.

2. Brake Cylinder – Brake Pipe – Red hand indicates locomotive brake-cylinder pressure; white hand indicates brake-pipe pressure.

3. Application-Suppression – Red hand indicates overspeed or safety control "penalty" application.

CUT-OUT COCKS (See Fig. 5 and 6)

At specified inspection or maintenance periods the following manually operated devices are used:

1. Main Reservoir Cut-out Cock – Located on the left side of the locomotive near the front main reservoir.

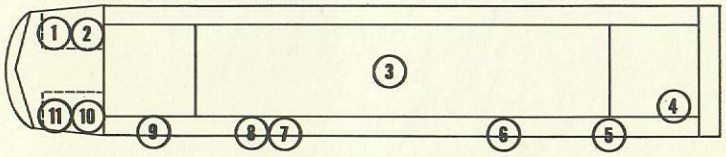
2. Main Reservoir Drain Cocks – One located on the end of each main reservoir arranged for automatic and manual draining. Turn valve handle full left for automatic drain. Turn handle full right for cutting out automatic drain. Normal drain is between these positions.

3. Air-filter Drain Cock – Located on left side of locomotive near the front main air reservoir.

4. Control-air Cut-out Cock – Located in left air-brake rack.

5. Control-air Reservoir Drain Cock – Located in right air-brake rack.

Fig. 5. (E-11947)



1 Engineman's position
- a First service position cock
- b Feed valve
- c Brake-pipe cut-out cock
- d Safety control cut-off
- e Double cut-out cock

2 Right air equipment rack
- a Control air reservoir drain cock
- b Control valve cut-out cock
- c Slip-suppression test buttons
- d Overspeed cut-out cock
- e Safety control cut-out cock (foot valve)
- f Dead engine cut-out cock

3 Compressor unloader cut-out cocks
4 Rear radiator shutter cut-out cock
5 No. 4 truck brake-cylinder cut-out cock
6 No. 3 truck brake-cylinder cut-out cock
7 Main reservoir cut-out cock
8 No. 2 truck brake-cylinder cut-out
9 No. 1 truck brake-cylinder cut-out
10 Helper's emergency brake valve
11 Left air equipment rack
- a Wheel-slip cut-out cock
- b Front radiator shutter cut-out cock
- c Dynamic braking - sanding cut-out cock
- d Control air cut-out cock
- e Bell, horn, and window wiper cut-out cock (In floor behind helper)

Fig. 5. Air brake and air equipment controls

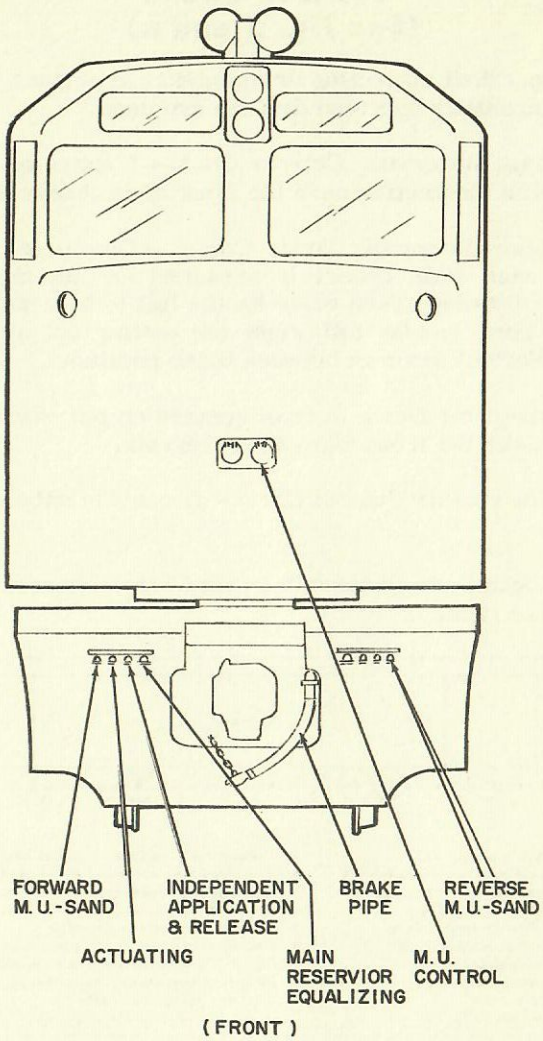


Fig. 6. Locomotive end connections

Fig. 6. (E-11949)

6. Brake-cylinder Cut-out Cocks – Located on left side beneath locomotive platform level (one for each truck).

7. Safety-control Cut-out Cock – Located in right air-brake rack. Cuts out safety control foot-valve feature when closed.

8. Bell, Horn, and Window Wiper Cut-out Cock – Located in compartment under floor behind helper's position.

9. Angle Cocks at Each End of Locomotive (Fig. 6).

a. Brake Pipe

b. Main Reservoir Equalizing

c. Independent Application and Release

d. Actuating

e. Forward Sand (Front – left side. Rear – right side) as viewed from end of locomotive.

f. Reverse Sand (Front – right side. Rear – left side) as viewed from end of locomotive.

10. Compressor Unloader Cut-out Cocks – Located between both air compressors in the middle of the locomotive.

11. Overspeed Control Cut-out Cock – Located in right air-brake rack.

12. Wheel Slip Cut-out Cock – Located in left air-brake rack.

13. Dead Engine Cut-out Cock – Located in right air-brake rack.

14. Control Valve Cut-out Cock – Located in right air-brake rack.

AIR EQUIPMENT

15. Double Cut-out Cock – Located under independent brake valve in engineman's position.

16. Dynamic Braking – Sanding Cut-out Cock – Located in left air-brake rack.

17. Front Shutter Cut-out Cock – Located in left air-brake rack.

18. Rear Shutter Cut-out Cock – Located on bulkhead in rear fan compartment.

ADJUSTING VALVES

AIR REGULATING VALVE (FEED VALVE)

The air regulating valve located on the air-brake stand, automatically maintains a predetermined air pressure in the brake system. A clockwise movement of the adjusting handle increases the pressure setting. A counterclockwise movement decreases the pressure setting. (Adjust to conform with railroad regulations.)

CONTROL AIR REDUCING VALVE

This valve maintains a predetermined, normal air pressure in the air supply for operation of the reverser, braking switch, and pneumatic contactors. Clockwise adjustment of the adjusting screw increases pressure. Normal control air pressure is 70 lb.

AUTOMATIC ALARMS AND SAFEGUARDS

CIRCUIT BREAKERS (See Fig. 3)

1. Operated like a toggle switch to open circuit manually.

2. Overload in a breaker circuit causes breaker to open the circuit automatically and the handle moves into center position indicating breaker has tripped.

3. Breaker is reset by moving to OFF, then to ON, after allowing a few minutes for thermal element in the breaker to cool. The breaker should only be reclosed if there is no visible reason for the automatic opening of the circuit. If it trips after reclosing, it should be left open unless instructed otherwise.

COLORED LIGHTS AND BELL

During normal locomotive operation, the bell and all colored lights are off. When locomotive consists of more than one unit, colored lamps will light on affected unit only. Bell will sound on all units.

NOTE: *If troubles occur on two or more units at the same time which cause the alarm bell to ring, turn the EC switch on all affected units to START position before attempting to restart any unit. When the throttle handle on the lead unit is beyond IDLE position, it is impossible to start any unit while the alarm bell is ringing.*

LOW-OIL AND LOW-WATER LIGHT (YELLOW) (See Fig. 3)

The yellow light on the Engine Control Panel will light when either the engine lube-oil supply or the cooling-water pressure is low.

1. If engine lubricating-oil pressure drops to between 10 to 14 psi at 400 rpm, or between 25 to 30 psi at 1000

rpm, the engine shuts down and the yellow LOW-OIL or LOW-WATER indicating lamp lights. If either engine shuts down, the alarm bell will sound as long as its engine control switch (EC) is in the RUN position. The yellow LOW-OIL or LOW-WATER indicating lamp will also come on if the water supply is low.

2. When either engine shuts down, return throttle handle to IDLE and move EC switch to START. Check lubricating-oil supply on dipstick. Check for broken or cracked oil lines. Also check water supply at storage tank and check for water piping leaks.

3. To restart diesel engine after fault is corrected:

a. Depress shut-down plunger on engine governor until it clicks and stays in.

b. Depress engine start button.

4. If engine fails to start due to LOW-OIL PRESSURE RESET button tripping, do not repeat cranking.

5. If locomotive units are being operated in multiple, then affected engine only, will shut down.

HOT ENGINE LIGHT (RED)
(See Fig. 3)

1. If engine water temperature becomes excessive, the alarm bell sounds and the HOT ENGINE indicating lamp (red) lights. At first opportunity investigate for cause. When cooling-water temperature returns to normal, alarm bell will stop ringing. Turning engine control switch (EC) to START will not stop the ringing of alarm bell or turn off the HOT ENGINE light. If cooling-water temperature does not return to normal in a reasonable length of time, shut down faulty engine.

NO BATTERY CHARGE (BLUE)
(See Fig. 3)

If engines are running and engine control switches (EC) are in RUN position and battery charging equipment fails on either engine, then a NO BATTERY CHARGE lamp (blue) will light and alarm bell will sound.

GROUND RELAY
(See Fig. 3)

1. a. If a ground occurs in the main power circuits of one of the power plants, the ground relay operates to reduce engine speed automatically to IDLE; removes power from traction motors of that power plant; and sounds the alarm bell.

The indicating pointer on the ground relay will point to the red dot on its target. The pointer can be seen through the round window on the plate covering each ground relay which is mounted on engine control panel.

b. If a ground occurs in the control circuits, the ground relay may operate during the engine cranking cycle. Report condition.

2. To reset relay:

a. Move throttle handle to IDLE.

b. Push in ground relay reset button on engine control panel.

c. Advance throttle handle. If ground relay stays in, continue normal operation.

3. If ground relay immediately operates a second time, affected power plant must not be operated. Engine must either be shut down or, if necessary, engine can be left running by turning EC switch to START. This takes power plant "off the line."

AUTOMATIC ALARMS AND SAFEGUARDS

PCS SWITCH

The pneumatic control switch (PCS) is operated from the air-brake system.

During a safety control "penalty" or emergency air-brake application, this switch opens. Engine speed is reduced to IDLE and power is removed.

To reset the PCS switch automatically:

1. Move throttle handle to IDLE.

NOTE: *If PCS switch has tripped while in dynamic braking the selector handle must be returned to OFF to reset the circuit.*

2. Move automatic brake-valve handle to LAP.

3. Depress safety control foot pedal. (When application pipe builds up to normal pressure, PCS will reclose.)

4. Move automatic brake-valve handle to RELEASE.

WHEEL SLIP

If any wheels slip during locomotive motoring, the following occurs:

1. A light brake application and a slight reduction in excitation occurs automatically on that half of the locomotive that is slipping.

2. When wheels stop slipping, brake application is removed automatically.

3. If wheels continue to slip for more than 2 or 3 seconds, wheel slip lamp (on master controller stand) lights and sand is automatically applied to the wheels of that half of the locomotive only.

AUTOMATIC ALARMS AND SAFEGUARDS

ENGINE OVERSPEED SHUTDOWN
(See Fig. 7)

In the event that an engine overspeeds to 1100 rpm, the engine is shut down automatically. After an overspeed-shutdown of the engine, move EC switch to START. Reset the overspeed mechanism by pushing in on knob located on the engine overspeed governor (Fig. 7). Proceed to start engine as described under STARTING ENGINE. If it overspeeds again do not restart the engine. If troubles occur on two or more engines at the same time which causes the alarm bell to ring, turn the EC switch on all affected engines to START position before attempting to restart any engine. With the

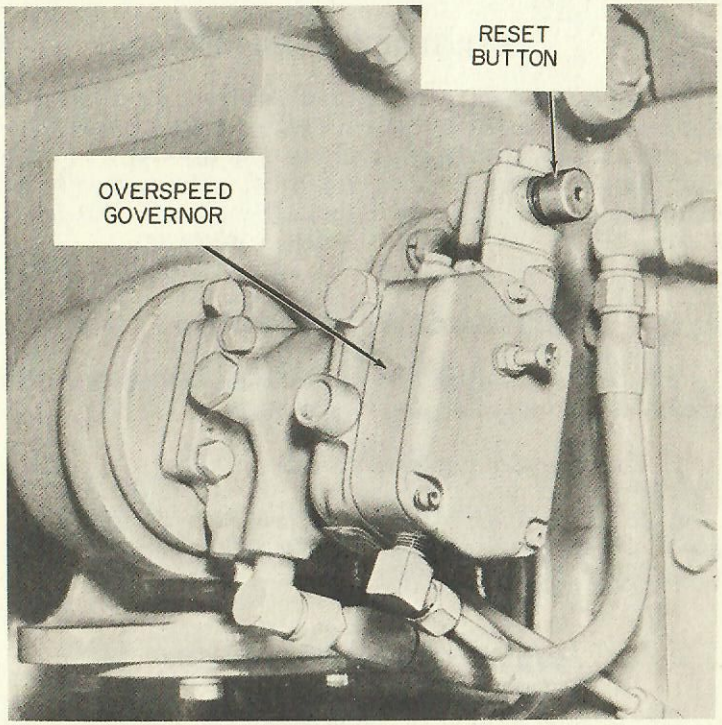


Fig. 7. (E-10129)

Fig. 7. Engine overspeed governor

throttle handle on the lead unit beyond IDLE position, it is impossible to start any engine while the alarm bell is ringing. (During freezing weather protect engine cooling system according to railroad instructions.)

SAFETY CONTROL FOOT PEDAL (See Fig. 1)

A foot pedal is located at the operator's position. Pedal must be depressed at all times during locomotive operation. If operator's foot is removed from the pedal for more than 5 seconds, brakes will apply at SERVICE rate. For further description see SAFETY CONTROL.

EMERGENCY SANDING

Emergency sanding is applied in forward and reverse directions automatically during all emergency brake applications, for a sufficient time to stop the train. In multiple-unit operation, emergency sanding is applied to all units regardless of whether they are equipped with pneumatic or electro-pneumatic sanding equipment.

LOCOMOTIVE OVERSPEED

When the locomotive exceeds the maximum permissible speed, an overspeed application is initiated.

1. The overspeed whistle blows.

2. In about 5 seconds a service-brake application is made. Overspeed application can be suppressed according to railroad regulations.

WATER PUMP OPERATION

The cooling system of each engine is separate. Each system is equipped with a motor-driven water circulating pump for cold weather protection.

To prevent a water system from freezing in cold weather when one engine is shutdown, the water pump of the dead engine is automatically powered by the fuel-pump breaker of the running engine to circulate water through a heat exchanger and through the system of the shutdown engine.

When both engines are running neither water pump will operate.

When both engines are shutdown, both fuel-pump breakers must be opened to prevent water pumps from operating and running down the battery.

MANUAL RADIATOR SHUTTER CONTROL (See Fig. 8)

In the event a failure should occur in the automatic operation of a set of radiator shutters, manually operated shutter levers may be positioned to furnish suitable radiator cooling until a repair can be made.

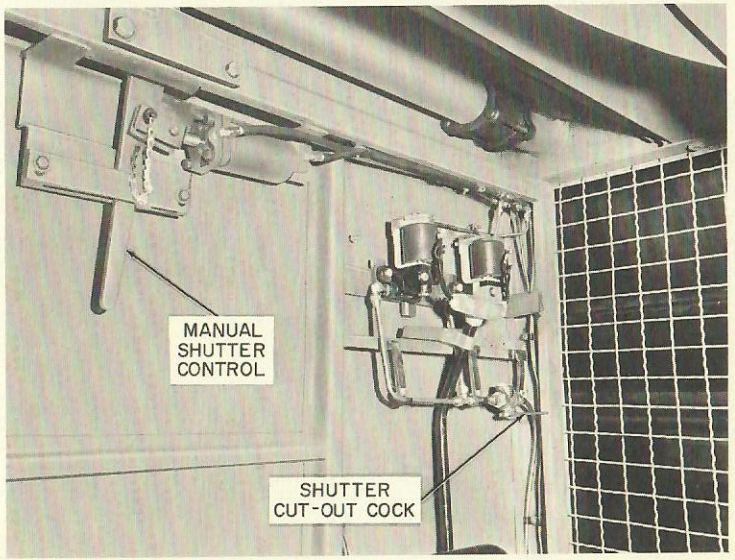


Fig. 8. (E-11959)

Fig. 8. Radiator shutter controls (rear fan room)

AUTOMATIC ALARMS AND SAFEGUARDS

Manual shutter levers (2) for the front radiator are located in the front fan room and near the turbocharger of the front engine. Levers (2) for the rear radiator are located in the rear fan room and near the turbocharger of the rear engine.

GAGES AND MEASURING DEVICES

DUPLEX AIR BRAKE GAGES (See Fig. 1)

1. Main Reservoir and Equalizing Reservoir

   a. Normal main reservoir pressure: 130 to 140 lb.

   b. Proper equalizing-reservoir pressure: should correspond with regulating valve setting and brake-pipe pressure.

2. Brake Cylinder and Brake Pipe

   a. Proper brake-cylinder pressure: "O" while in running position. Approximately 45 lb. when independent brakes are fully applied.

   b. Proper brake-pipe pressure: should correspond with regulating valve setting and equalizing reservoir pressure.

3. Application

   a. During normal air-brake operations, main-reservoir pressure is registered. When a penalty occurs, caused by locomotive overspeed or safety control (if used), the warning whistle will sound and gage pressure will start reducing.

PRESSURE AND TEMPERATURE GAGES

1. Control Air – Located in left air-brake rack. Normal air pressure 70 psi.

2. Intake Manifold Air-pressure Gages – Located on left side of locomotive near the air compressors. (See Fig. 9.) Normal reading at full engine speed and full load is about 16.5 psi.

3. Fuel Pressure Gages – Located on left side of locomotove near the air compressors. (See Fig. 9.) Normal fuel pressure at idle is 60 psi and at full load is 40 psi.

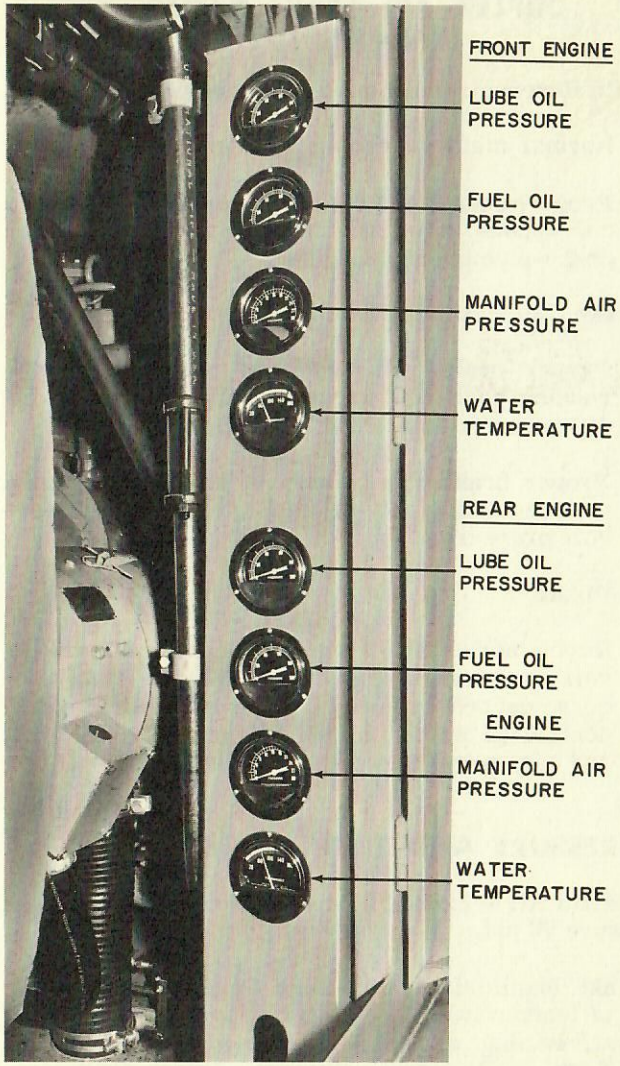


Fig. 9. (E-11961)

Fig. 9. Engine gage panel

4. Lube-oil Pressure Gage – Located on left side of locomotive near the air compressors. (See Fig. 9.) Normal lube pressure at idle is 20 psi and at full load is 50 psi.

5. Water Temperature Gage – Located on left side of locomotive near the air compressors. (See Fig. 9.) Normal operating temperature is 170-180 F.

OTHER GAGES

1. Engine Lubricating-oil Dipstick – one located on each side of engine near lube-oil fill. The stick is marked HIGH and LOW. (See Fig. 18.) Proper level with engine idling is between HIGH and LOW.

2. Fuel-oil Level Gages – mounted on both sides of the main fuel tank to indicate level of fuel in the tanks. (Fig. 10.)

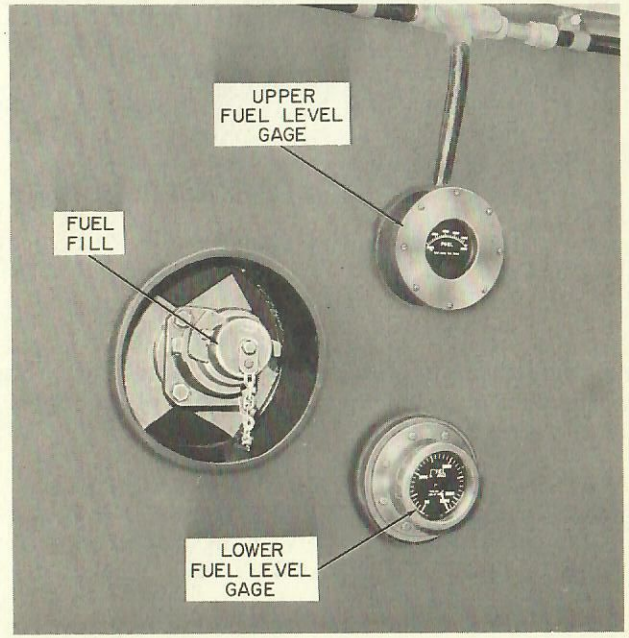


Fig. 10. (E-11962)

Fig. 10. Fuel tank details

GAGES AND MEASURING DEVICES

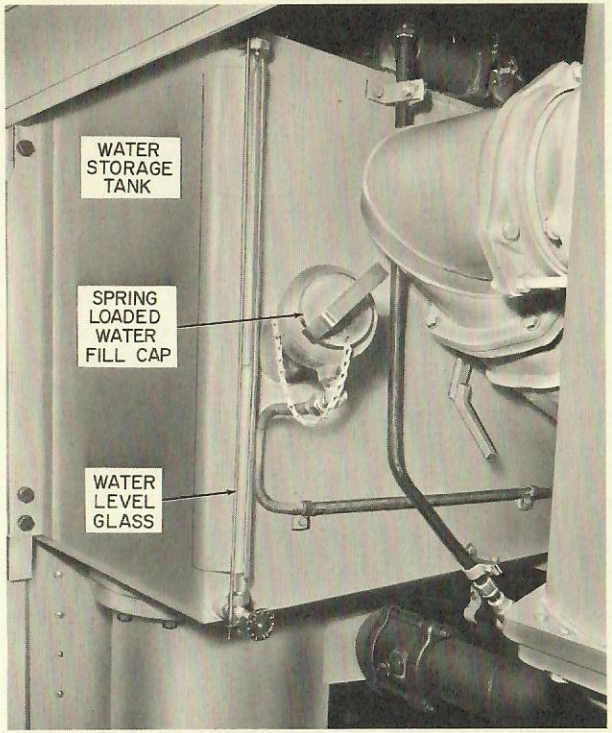


Fig. 11. (E-11963)

Fig. 11. Water storage tank details

3. Cooling Water – a sight glass mounted on side of cooling water supply tank indicates level of cooling water in the system. Markings on tank indicate proper level for conditions. (See Fig. 11.)

WARNING: TO AVOID PERSONAL HARM FROM WATER BURNS, NEVER REMOVE WATER FILL CAP WHEN WATER LEVEL IS ABOVE FILL PIPE ON WATER STORAGE TANK.

4. Compressor Lube Oil – Maintain to RUN level on oil lever indicator gage. (See Fig. 12.)

GAGES AND MEASURING DEVICES

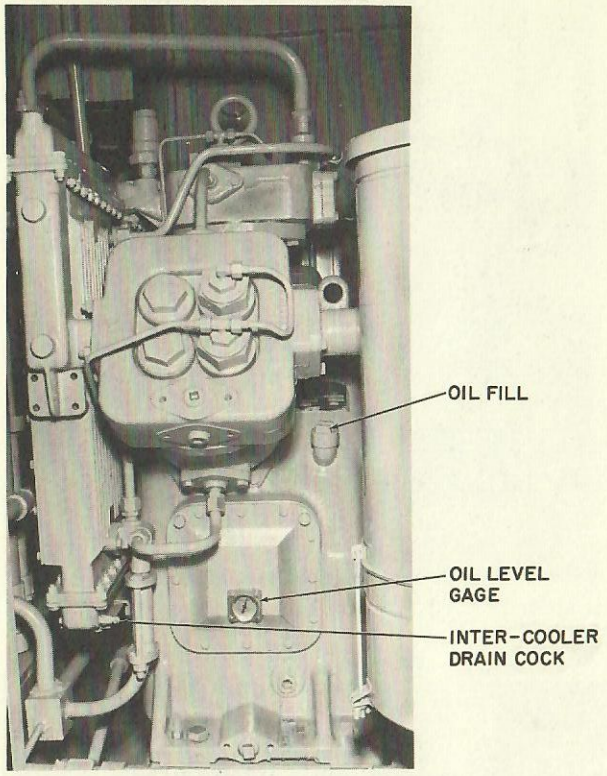


Fig. 12. (E-11826)

Fig. 12. Air compressor

5. Traction-generator Gear Box – has a dipstick marked EMPTY – ADD – FULL. Proper level is between ADD and FULL with engine stopped. (See Fig. 13.)

6. Fan-gear Unit – maintain oil level to top mark on dipstick. (See Fig. 14.)

7. Governor Oil-level Sight Glass – located on side of engine near traction generator. (See Fig. 15.) Oil level must be visible between marks on sight glass when engine is running.

GAGES AND MEASURING DEVICES

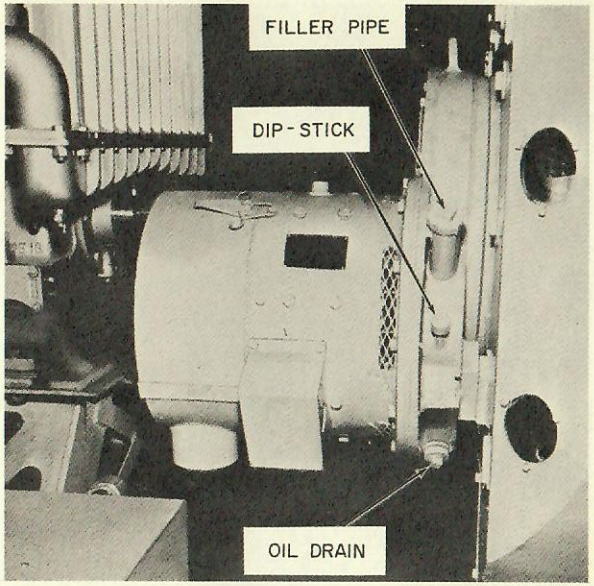


Fig. 13. Traction generator gear unit

Fig. 13. (E-10130)

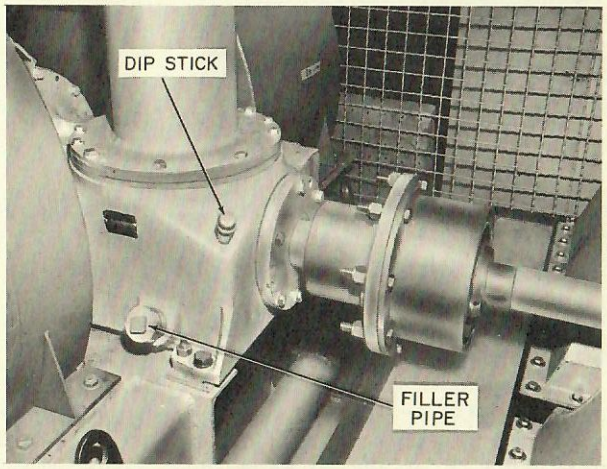


Fig. 14. Fan gear unit

Fig. 14. (E-11964)

Fig. 15. (E-11828)

PREPARATION FOR OPERATION

The following checks and inspections should be made in accordance with railroad rules.

BEFORE BOARDING LOCOMOTIVE

1. Inspect for broken, worn, loose, or dragging parts (brake rigging, brake shoes, wheels, traction-motor commutator covers, etc.).

2. Check for leaks from outside piping.

3. Properly position all drain and cut-out cocks.

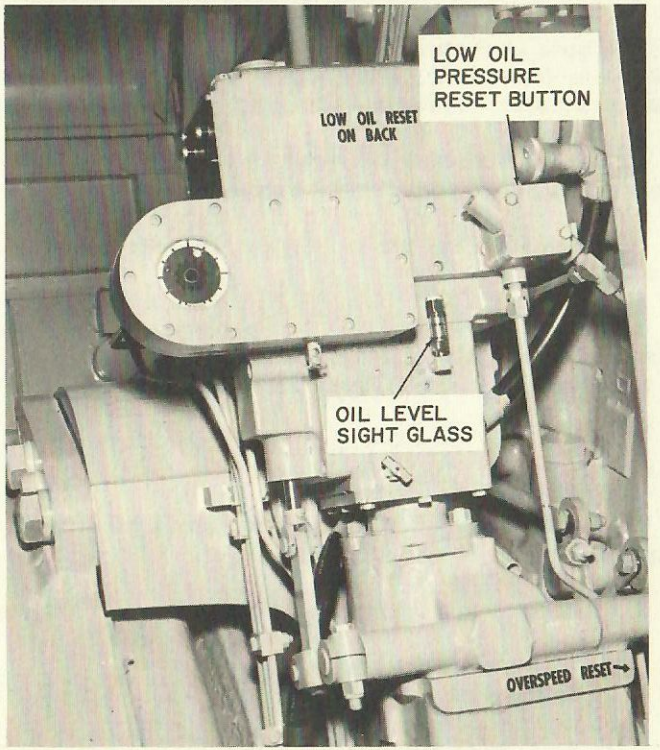


Fig. 15. Engine control governor

4. Check proper connection of air hoses and jumper cables (if in multiple with other units).

5. Check fuel supply on fuel tank level gages.

AFTER BOARDING LOCOMOTIVE

1. Remove rags, tools, etc., from moving parts and electric equipment.

2. Check lubricating-oil supply of both diesel engines. Oil level should indicate FULL on measuring gage with engine shut down. A measuring gage (dipstick) is located on each side of engine and is marked LOW-FULL.

3. Check governor oil supply. Sight glass on governor should be full of oil. After engine is started, oil must be visible between marks on the sight glass. (See Fig. 15.)

4. Check lubricating-oil supply on both air compressors. Main oil supply to RUN level on gage.

5. Check cooling water supply. Be sure that water drain valves are closed.

6. Check lubricating-oil of generator gear units. Dipstick is marked EMPTY - ADD - FULL. Proper level is between ADD and FULL marks. (See Fig. 13.)

7. Check that diesel-engine overspeed device is reset (Fig. 7.)

8. Check that engine barring device is removed from engines.

9. Check that the following air cut-out cocks are open:

a. Compressor unloaders
b. Control air
c. Safety control
d. Bell, horn and window wiper
e. Overspeed control

10. Check that brake-pipe cut-out cock is "cut-in" (horizontal position).

11. Double cut-out cock beneath independent brake valve should be as required for locomotive position in consist.

12. Check that first service cut-out cock is positioned as required.

13. Check positions of automatic and independent brake-valve handles.

14. Move engine control switch to START.

15. Properly position MU headlight selector switch.

16. Check that throttle handle is in IDLE, selector handle in OFF, and reverse handle in OFF.

17. Check that dead-engine cock is in LIVE (or closed) position.

STARTING ENGINE

1. Perform operations as in BEFORE BOARDING LOCOMOTIVE and AFTER BOARDING.

NOTE: *If either engine has been stopped for a considerable period of time, the cylinders should be cleared of fuel or water accumulation before starting the engine.*

Proceed as follows:

a. Apply engine barring-over device and back off compression relief plugs on left side of each cylinder.

b. Rotate engine at least two complete revolutions by use of the engine barring-over device.

c. Remove barring-over device from engine and tighten all compression relief plugs before cranking.

2. Check that emergency stop switch is in RUN:

3. Check that neither ground relay indication pointer does not point to red dot. Check that cause of ground relay operation has been removed and then push reset button to reset relay.

4. Close battery switch located in rear bulkhead of operator's cab.

5. Close the following circuit breakers on the engine control panel:

a. Control Circuit

NOTE: *When starting engines of several locomotives in multiple-unit consist, start engines one at a time. Close control circuit breaker only on one unit. Push fuel-pump reset button and allow fuel pumps to run a few seconds before starting engines.*

b. Charging Circuit
c. Battery Negative
d. Trainline Fuel Pump (Lead unit only)
e. Fuel Pump
f. Headlights
g. Running Lights

6. Push desired engine start button on engine control panel and hold until engine starts (approximately 25 seconds).

NOTE: *If proper engine lube-oil pressure does not build up within approximately 40 seconds, governor will shut off fuel and prevent engine from starting.*

CAUTION: DO NOT DISCHARGE BATTERY EXCESSIVELY BY REPEATED ATTEMPTS TO START. IF FIRST TWO OR THREE TRIES ARE UNSUCCESSFUL, RECHECK STARTING PROCEDURE.

BEFORE MOVING LOCOMOTIVE

1. Turn each engine control switch to RUN.

2. Make air-brake test and other checks in accordance with railroad regulations.

3. Check main reservoir air pressure according to railroad rules.

4. Check control air pressure. Normal 70 psi.

5. Make independent air-brake application. Release hand brake and remove any blocking of the wheels.

6. Allow time for engine cooling water to warm up before moving locomotive in accordance with railroad rules.

FASTER AIR PUMPING

To provide faster air pumping on locomotive, when reservoirs have been drained, or after locomotive has been coupled to a train, proceed as follows:

1. Leave generator-field circuit breaker in OFF position.

2. Close both control breakers on engine control panel.

3. Leave reverse handle in OFF position.

4. Move selector handle to 1.

5. Move throttle handle to 4th or 5th notch as needed.

OPERATING PROCEDURE

MOVING A TRAIN

1. Close generator-field circuit breaker on master controller cover.

2. Move reverse handle to FORWARD or REVERSE position, depending on direction of movement desired.

3. Move selector handle to 1.

4. Place foot on safety control foot pedal and release brakes completely. Several minutes may be required to release brakes, depending on length of train.

5. Advance throttle handle

6. The throttle handle has full notches and half notches (IDLE up to NOTCH 8), with each successive notch representing an increase in power, or locomotive tractive effort.

Starting a train depends on type, length, weight, grade, condition of rail, and amount of slack in train. This locomotive is designed to have easily-controlled tractive effort build-up characteristics, with the tractive effort in each notch limited to definite values as the throttle is moved from the lowest to the highest notch. The engineman can easily control amount of tractive effort required to start and accelerate a particular train. Speed can be controlled as desired by reducing or increasing throttle position.

STOPPING A TRAIN

Move throttle handle to IDLE and apply air brakes according to railroad regulations. If leaving operator's position after train has stopped move selector and reverse handles to OFF.

OPERATING PROCEDURE

REVERSING LOCOMOTIVE

1. Bring locomotive to a full stop.

2. Move reverse handle to opposite direction.

3. Release brakes.

4. Open throttle.

PASSING THROUGH WATER

Do not exceed 2 or 3 mph if there is water over the rails. Do not pass through water that is over 2.5 inches above top of rail.

PASSING OVER RAILROAD CROSSINGS

Do not pass over railroad crossings at full power, or traction-motor flash-over may result. Reduce power by moving throttle handle to 5th NOTCH, or below, while all units are passing over crossing.

WHEEL SLIP

When a slip occurs, a light independent air-brake application is made automatically. This may be observed by a fast flicker of the needle of the brake-cylinder air gage. At same time excitation is slightly reduced automatically. Most slips will be corrected by this automatic action.

If bad rail conditions cause the slip to exceed 3 seconds then sand is automatically applied to the rail. Wheel-slip light will come on at about the same time sanding starts. When wheel slips cannot be controlled by braking and sanding, the excitation is reduced automatically.

OPERATING PROCEDURE

If, in the engineman's judgement, the wheel slip is not corrected by the automatic control, it may be necessary to reduce throttle position or apply sand, or both, until wheel slip is fully corrected.

STOPPING ENGINES

1. Move throttle handle to IDLE.

2. Open generator-field circuit breaker on master controller stand.

3. Move each engine control switch to START.

4. Momentarily press each STOP button, on engine control panel.

5. To shut down all engines when in multiple-unit operation, move MU-ENG EMERGENCY SHUTDOWN SWITCH on master controller to STOP. EMERGENCY SHUTDOWN SWITCH must be in RUN before attempting to start engine.

BEFORE LEAVING LOCOMOTIVE

1. Apply hand brake and release air brakes after uncoupling from train.

2. Leave Throttle in IDLE and Selector in OFF. Remove reverse handle after moving to OFF.

3. Open all switches and circuit breakers.

4. Close windows and doors.

5. Open battery switch.

6. In freezing weather, precautions must be taken to see that the cooling water does not freeze. See DRAINING COOLING SYSTEM and WATER PUMP OPERATION and follow railroad rules for this situation.

SAFETY CONTROL

Safety control consists of a foot-pedal operated air valve, whistle and a cut-out cook. Except when the locomotive is stopped and locomotive brakes are applied, the engineman must keep the safety control foot pedal depressed at all times. This prevents safety control brake application.

After a penalty brake application has occurred, normal locomotive operation is restored in the following manner:

1. Move throttle handle to IDLE.

2. Move automatic brake valve handle to LAP.

3. Depress safety control foot pedal. (See Fig. 1.)

4. After application pipe has built up to normal pressure, move automatic brake-valve handle to RELEASE.

DYNAMIC BRAKING OPERATION

Dynamic braking is applied to the locomotive only. A dynamic brake interlock keeps the air brakes on the locomotive from being applied when automatic air braking and dynamic braking are being used.

APPLYING DYNAMIC BRAKING

Applying dynamic braking is done in the following manner:

1. Move the throttle handle to IDLE.

2. Move the selector handle from 1 to OFF to B.

3. Advance the throttle handle slowly to bunch train slack. (Braking is now controlled by the throttle handle.)

4. After the slack is bunched, advance the throttle handle until the desired braking effort is obtained. Observe and correct braking effort during initial period of dynamic brake application.

CAUTION: DO NOT OPERATE IN 8TH NOTCH DYNAMIC BRAKING FOR MORE THAN 5 MINUTES AT SPEEDS ABOVE 61 MPH.

The amount of braking effort obtainable varies with the position of the throttle for the various speeds. Maximum braking effort is obtained in the 8th NOTCH at approximately 24 mph.

NOTE: *Wheel-slip warning may occur while in dynamic braking. This indicates that wheels are sliding. Sand is applied automatically to the wheels of the sliding unit. Reduce throttle position until warning stops.*

DYNAMIC BRAKING OPERATION

USE OF AIR BRAKES DURING DYNAMIC BRAKING

When necessary, the automatic air brake may be used in conjunction with the dynamic brake. Automatic air brakes will apply on the train but not on the locomotive. If the automatic air-brake handle is moved to the emergency position, dynamic brake is removed and brakes on the locomotive as well as those on the train go into emergency application.

The independent air brake must not be used during dynamic braking to avoid flat spots on the locomotive wheels caused by sliding.

RELEASE OF DYNAMIC BRAKING

Release dynamic braking in the following manner:

1. Move the throttle handle to IDLE.

2. Move the selector handle from B to OFF to 1.

OPERATING AS LEADING UNIT

To operate the locomotive as a lead unit of a consist proceed as follows:

1. Make the necessary preliminary preparations for operation.

2. Test air brake in accordance with railroad rules.

3. Close trainline fuel-pump breaker.

4. Close the generator-field circuit breaker.

5. Move reverse handle to the desired direction.

6. Operate locomotive in accordance with operating procedure.

OPERATING AS TRAILING UNIT

Air Equipment Set-up

1. Make a full service application with the automatic brake-valve handle.

2. Move the brake-pipe cut-out cock to the cut-out position.

3. Move the automatic brake-valve handle to the HANDLE OFF position and remove the handle.

4. Move the double cut-out cock under the independent brake valve to the cut-out position (horizontal).

5. Place the independent handle in RELEASE position.

Electrical Set-up

1. Move the reverse handle to OFF and remove the handle.

2. Place the selector handle in OFF position. (Leaving the handle in position 1 on the trailing unit prevents loading when in multiple with some type locomotives).

3. Open the generator-field circuit breaker on the master controller. Leave all breakers in the closed position on the engine control panel (EC) except the Control Circuit Breaker and the Trainline Fuel Pump Breaker. Running-lights circuit breaker should be left ON in cold weather for hopper tank heat.

4. Place the M.U. Headlight Set-up switch in the proper position.

CHANGING OPERATING ENDS

To change operating control from the cab of one locomotive unit to the cab of another proceed as follows:

Vacating Unit — Air Equipment Set-up

1. Make a full service brake-pipe reduction.

2. Move the brake-pipe cut-out cock to the CUT-OUT position.

3. Place the automatic brake-valve handle in the HANDLE-OFF position and remove; place the independent brake valve handle in the RELEASE position.

4. Move the double cut-out cock under the independent brake valve to the cut-out position (horizontal).

Vacating Unit — Electrical Set-up

1. Move the reverse handle to OFF and remove the handle.

2. Place the selector handle in OFF position.

3. Open the generator-field circuit breaker on the master controller.

4. Leave all breakers in the closed position on the engine control panel (EC) except the Control Circuit Breaker. Running-lights circuit breaker should be left ON in cold weather for hopper tank heat.

5. Move the M.U. Headlight Set-up switch to required position.

6. Open trainline fuel-pump breaker just before taking control of other operating cab.

Operating Unit — Air Equipment Set-up

NOTE: *Immediately close trainline fuel-pump breaker.*

1. Insert the automatic brake-valve handle in the HANDLE-OFF position.

2. Move the independent brake-valve handle to the full application position.

3. Cut-in the double cut-out cock (vertical).

4. Cut-in the brake-pipe cut-out cock (horizontal).

Operating Unit — Electrical Set-up

1. Insert the reverse handle into the reverser of the master controller.

2. Close the generator-field circuit breaker on the master controller.

3. Close all circuit breakers on the engine control panel (EC).

4. Move M.U. Headlight Set-up switch to required position.

TO OPERATE WITH OTHER TYPES OF UNITS

If the units of the locomotive consist are geared for differing maximum speeds, do not run at speeds in excess of that recommended for the unit having the lowest maximum permissible speed.

Similarly, do not operate at low speeds long enough to exceed the specified traction-motor ratings on any of the units in the locomotive consist. The U50 locomotive, because of its high horsepower per axle, will develop more tractive effort at any given speed than will units of lower horsepower per axle.

When the leading unit is slipping excessively the power limit switch can be moved to NOTCH 7 to reduce the power on the first four axles of the lead unit, while the trailing units are operating at full power. This will reduce the tractive effort on the first four axles of the lead unit and will usually improve the ability of the locomotive to hold the rail under bad rail conditions.

Units equipped with braking-current limiting regulators can be operated in multiple with U50 locomotives in dynamic braking, regardless of the gear ratio or differences in maximum braking ratings. If some units do not have current-limiting regulators, the trainline brake warning on the control stand will light indicating that rated braking current is being exceeded.

DEAD HEADING

1. Place the independent brake-valve handle in RELEASE position and the automatic brake-valve handle in RUNNING (HANDLE-OFF) position.

2. Move the brake-pipe cut-out cock to the CUT-OUT position.

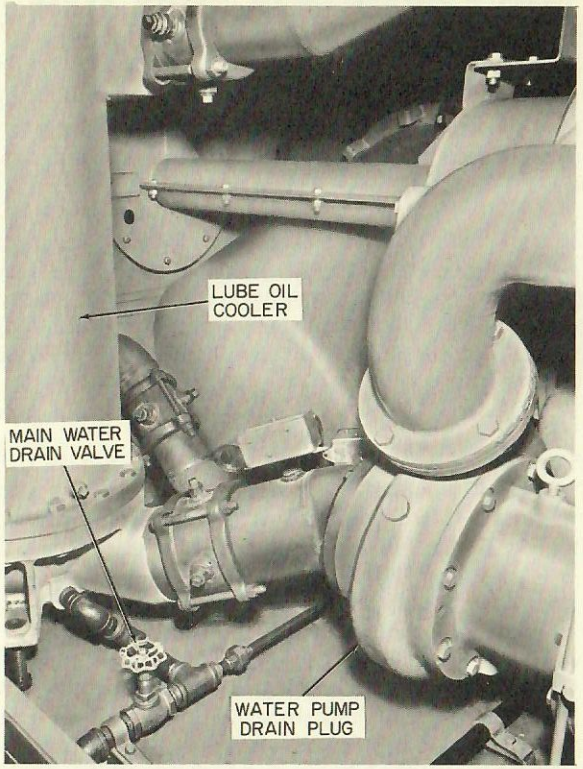


Fig. 16. (E-11965)

Fig. 16. Water system drain

3. Move the double cut-out cock to the CUT-OUT position.

4. Open the dead engine fixture cut-out cock.

DRAINING COOLING SYSTEM

For weather above freezing, each cooling water system may be drained by opening the main water drain valve near the base of each engine lube-oil cooler. (See Fig. 16.)

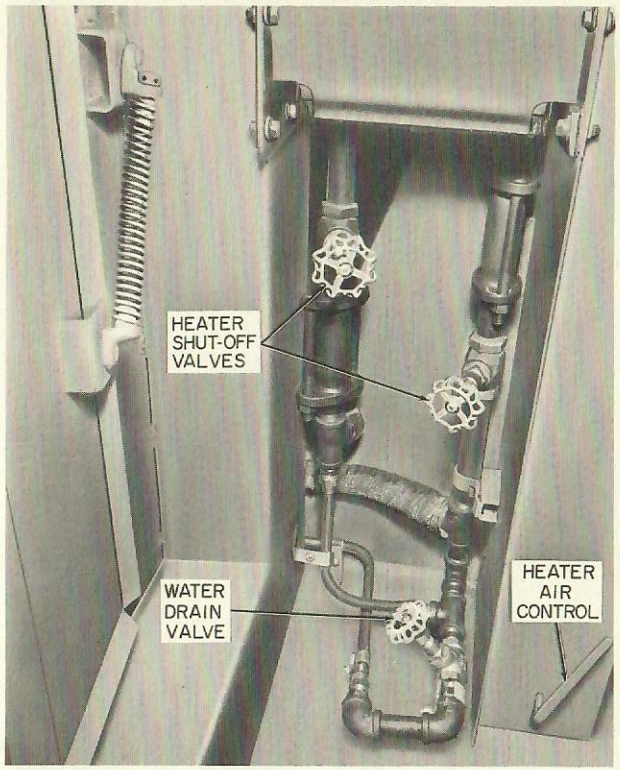
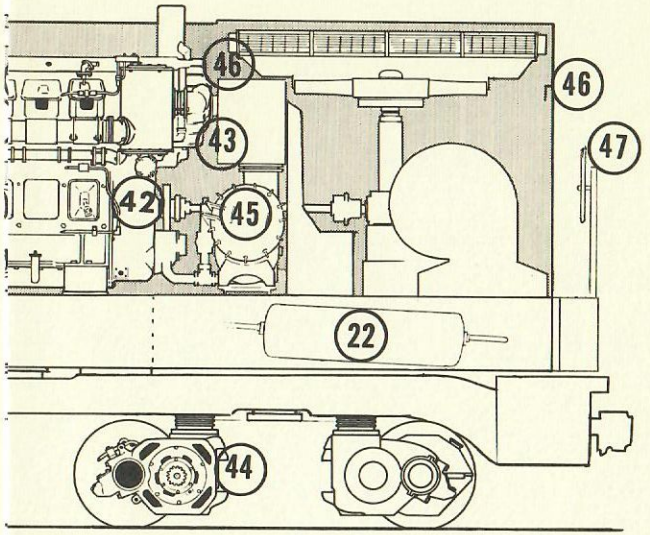


Fig. 17. (E-11966)

Fig. 17. Cab heat control and drain valves

For freezing weather, in addition to opening the main drain valves, remove the plugs at the base of each water pump (gear driven) and be sure that both cab heater valves and drain valve in the nose compartment are open. (See Fig. 17.)

Fig. 18. (E-11950)



h sides)

or gear case
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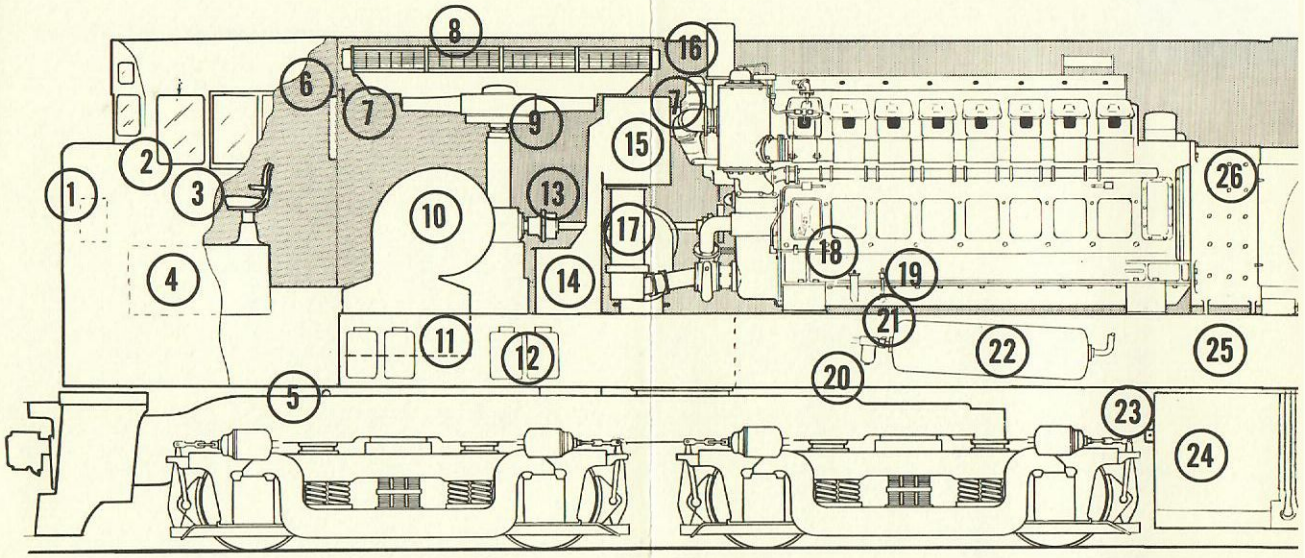
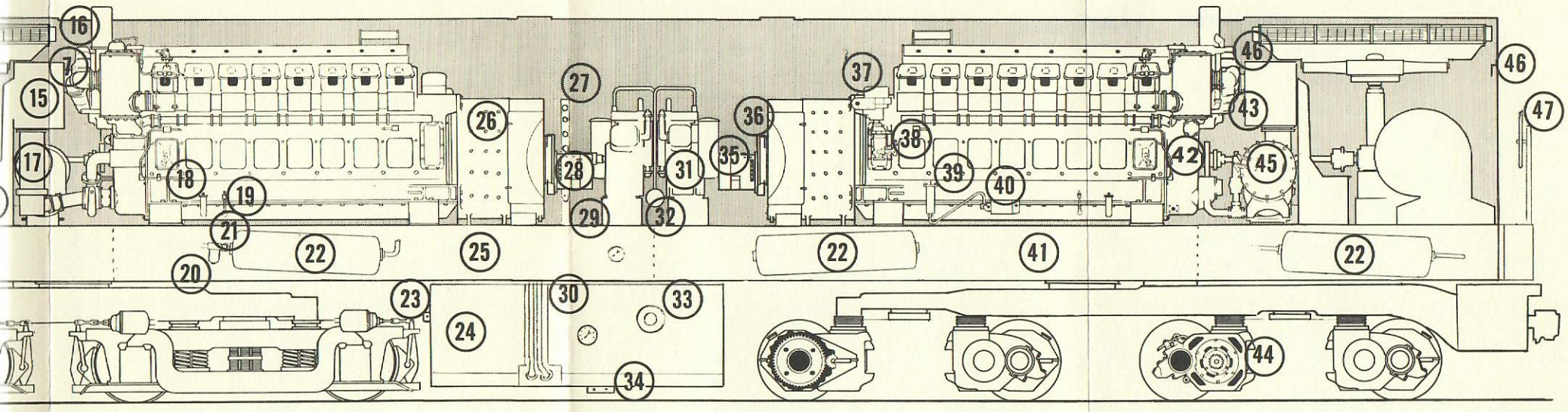
ntrol (rear)

Fig. 18. Apparatus location

Fig. 18. (E-11950)



1	Cab heater	17	Lube-oi
2	Operating controls and gage panel	18	Lube-oi
3	Air brake controls	19	Lube-oi
4	Air equipment rack (right and left)	20	"H" air
5	Battery charging receptacle	21	Main re
6	Engine control panel	22	Main ai
7	Manual shutter control (front)	23	Emerge (both
8	Radiator	24	Fuel ta
9	Radiator fan	25	Front c (righ
10	Front equipment blower	26	Tractio
11	Front primary air cleaner	27	Engine
12	Battery compartment (right and left)	28	Auxilia:
13	Flexible coupling	29	Water r
14	Secondary air cleaner	30	Fuel le
15	Water storage tank	31	Air con
16	Turbocharger		



eater
ting controls and gage panel
rake controls
quipment rack (right and left)
ry charging receptacle
e control panel
l shutter control (front)
tor
tor fan
equipment blower
primary air cleaner
ry compartment (right and
t)
ple coupling
dary air cleaner
storage tank
charger

17 Lube-oil cooler
18 Lube-oil filler (both sides)
19 Lube-oil dipstick (both sides)
20 "H" air filter
21 Main reservoir cut-out cock
22 Main air reservoir
23 Emergency fuel-trip button (both sides)
24 Fuel tank
25 Front control compartment (right side)
26 Traction generator
27 Engine gage panel
28 Auxiliary generator
29 Water motor-pump set
30 Fuel level gages
31 Air compressor
32 Heat exchanger
33 Fuel tank fill (both sides)
34 Fuel tank sump
35 Exciter
36 Traction-generator gear case
37 Engine control governor
38 Overspeed governor
39 Fuel strainer
40 Fuel booster pump
41 Rear control compartment (right side)
42 Lube-oil strainer
43 Water fill (pressurized)
44 Traction motor
45 Lube-oil filter
46 Manual shutter control (rear)
47 Handbrake

Fig. 18. Apparatus location